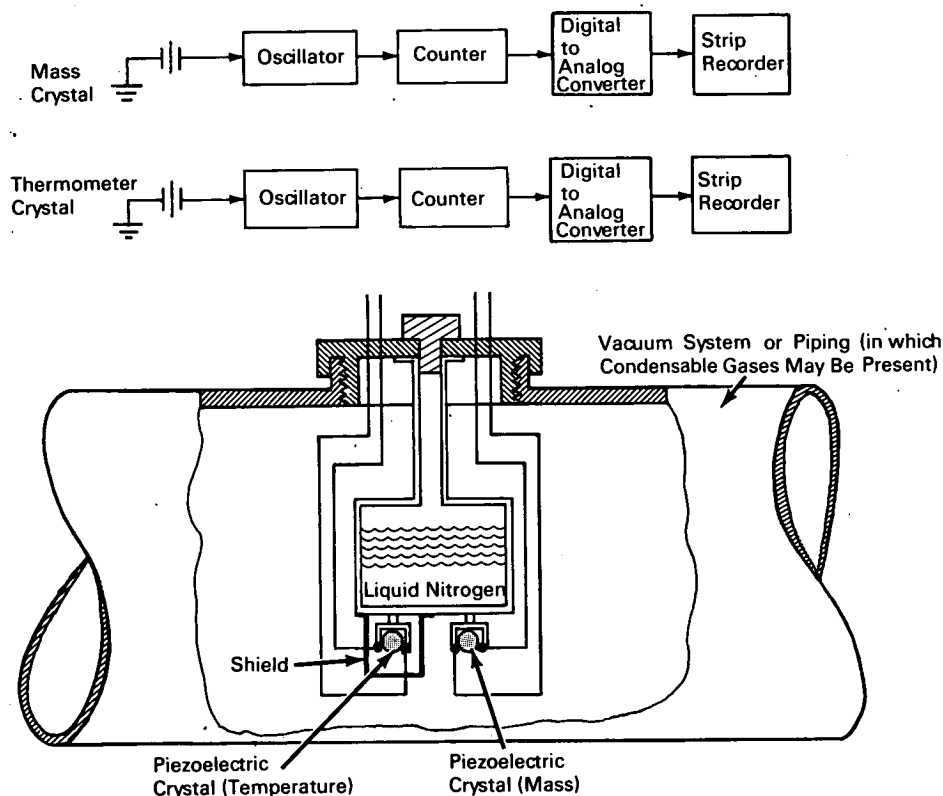


NASA TECH BRIEF



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Quartz Crystals Detect Gas Contaminants During Vacuum Chamber Evacuation



The problem:

To develop a device for detecting the presence of a condensable gas contaminant backstreaming into a vacuum chamber when a vacuum pump is being used to evacuate the chamber. Prior art used glass slides placed in the line from the vacuum chamber to the pump, which allowed the condensable contaminants to condense on the glass slides. The glass slides were then taken from the line, washed in a solvent, and the resulting fluid analyzed to determine whether a

contaminant was present (such as oil). This was a laborious and time consuming process.

The solution:

An apparatus which consists of two piezoelectric quartz crystals mounted on a cooled support, one of which acts as a thermometer, the other detects a change in mass. Associated electronic equipment energizes the piezoelectric crystals and records changes in frequency from the crystals.

(continued overleaf)

How it's done:

To condense the contaminant, liquid nitrogen or any liquid cool enough to allow the contaminant to condense, is used to fill the container upon which the crystals are mounted. One of the crystals is encased in a shield so that it is responsive only to temperature. The other crystal is open to receive the condensable contaminants so that a change in mass results from the deposit of contaminants upon the crystal. Increasing the mass of the crystal decreases the frequency with which it vibrates.

As the air is pumped out, any contaminants backstreaming into the vacuum chamber will be condensed on the mass-determining crystal, reducing its vibrating frequency. The other crystal monitors the temperature. Since the frequency with which a crystal vibrates is dependent upon temperature, it is necessary that the temperature be monitored so that a period during which there is a constant temperature may be used to make an accurate determination of the amount and presence of contaminants being collected or condensed on the mass-determining crystal. The change in frequency is registered by the counter and the strip recorder.

Notes:

1. The device has been fabricated and used at the Jet Propulsion Laboratory to indicate the presence of condensable contaminants backstreaming into a vacuum chamber being evacuated.
2. The device offers the following advantages:
 - (a) it provides a remote and continuous time rate of change of contaminants condensing on a surface;
 - (b) it is sensitive to 1×10^{-10} grams per sq. cm.
3. Inquiries concerning this invention may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: B67-10205

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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(NPO-10144)